Autofs NG – The new Linux automounter

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Agenda

- History of Autofs

- Summary of functionality

- Comparisons

- Autofs NG

History of Linux Autofs

- Autofs 3 - created by H. Peter Anvin ~ 1997

- Autofs 4 - created by Jeff Fitzhardinge

- Autofs 4.1 – maintained by Ian Kent

- AMD - BSD4.4

Autofs 3

- Supported basic autofs functionality

  – No direct maps

  – No browsing

  – No multimounts

  – No nsswitch.conf support

    – Resulted in Linuxisms (yp:auto_home)

Autofs v4

- Based off v3

- Added rudimentary support for multimounts

- Yay! /net access (sorta..)

  – Used custom program maps to simulate the special -hosts map.

Autofs v4 (cont)

- ## Multimounts are mounted all at the same time.

  - Originally 'all or nothing' approach
  - 'nostrict' option later added to deal with errors.

- ## Still no direct mount support.

- ## Still no browsing support.

Autofs v4.1

- ## Ghosting (like browsing)

  - Indirect map entries picked up by the wildcard key stick around

- ## Direct(ish) map support

  - Direct maps are translated into indirect maps internally -> leads to 'covering' directories

AMD

- ## Different syntax

  - more powerful

  - more confusing (IMHO)

- ## Portable

  - Implemented in userspace

  - Ported to Tru64, BSDi, Linux, Solaris, Irix and AIX

AMD (cont)

- ## Uses a userspace NFS server

  - Traps on lookups of non-existent files

  - Processes map entry

  - Mounts the filesystem in some other location

  - Returns a newly created symlink that points to the mounted filesystem

- ## Leads to the classic /bin/pwd problem

Design problems(v3->4.1)

- ## Kernel -> Userspace:

  – Communication done through pipe passed in at mount time.

  – Broken pipe -> broken mount

- ## Userspace -> Kernel

  – Ioctls on the base directory of the indirect mount

  – Does not work well with direct mounts (directory is covered!)

Feature Comparison

	v3	v4	v4.1
Indirect Maps	Y	Y	Y
Direct Maps	N	N	Sort of
Browsing	N	N	Sort of
Native -hosts	N	N	N
Multimounts	N	Sort of	Soft of

Goals

- Support:

  - indirect mounts

  - direct mounts

  - multimounts

  - browsing

- Allow transparent use of maps by Commercial Unix (Solaris in particular)

Secondary Goals

- Support Linuxisms

  - mapname nameservice prefixes (program:, yp:, nisplus: ldap:)

  - Hesiod support

  - CD changer support

- Iterable program maps

Design – The Situation

- ## Current design had flaws

  - Communications channels did not allow direct mounting nor multimounts

  - Linux per-process mount table namespaces would break autofs mounts

  - Current design would get 'stuck' if deamon killed

Design – Requirements

- ## New means of communication

  - Must be able to communicate with direct mounts

- ## Remove duplicated state between kernel and userspace

- ## Be able to deal with userspace updates and brokenness

  - w/o hanging the machine :)

Design – Trapping

- ## Provide magic filesystem

  - ### Two modes of operation

    - #### Direct – Traps on entry into root directory

    - #### Indirect – Traps on entry into any child directory

  - ### Trapping performed by calling out to userspace (/sbin/autofs)

    - #### Done in namespace context of the trapping application (but as root)

    - #### Assumes administrator trusts /sbin/autofs

Design – Expiry

- ## Handled in the kernel

  - Provided as a generic facility

- ## Atomic expiry of trees

  - Trees can be tagged to expire as part of an expiring subtree

- ## Flaw – Userspace has no notification that the expiry occurred.

Example – Indirect

/etc/auto_master:

```
/home     /etc/auto_home
```

/etc/auto_home:

```
mikew    bignfs.mydomain.com:/export/mikew
stews    bignfs.mydomain.com:/export/stews
```

Example – Indirect (cont)

- ## When automount(8) is run:

```
mount -o indirect,mapname=/etc/auto_home -t
   autofs none /home
```

- ## When /home/mikew is accessed, kernel calls:

```
MAPNAME=/etc/auto_home \

MAPKEY=mikew \

MOUNTFD=3 \

/sbin/autofs mount
```

Example – Indirect (cont)

- /sbin/autofs:

    - Looks up $MAPKEY in $MAPNAME

    - Mounts found filesystem

    - Moves filesystem to directory specified by $MOUNTFD

    - Returns 0

- Kernel lets userspace walk into the newly available filesystem

Example – Direct

- Direct mounts are done in the same way:

- ```
  mount -o direct,mapname=/etc/auto_direct,mapkey=/full/path -t
  autofs none /full/path
  ```

- MAPNAME=/etc/auto_direct

- MAPKEY=/full/path
  - (specified at autofs mount time, no runtime resolution done)

Lazy Multimounts

- Handle by installing direct mounts within mounted filesystems

- Introduces the concept of entry offsets

- Example:

```
/usr/src    /      bignfs:/export/sources \
        linux   othernfs:/export/linux
```

Multimounts (cont)

/usr/src   /   bignfs:/export/sources   \
                              linux   othernfs:/export/linux

/

usr/

src/

← -t ext3 /dev/hda1

/

← -t autofs
-o mapname=/etc/auto_direct
-o mapkey=/usr/src

Multimounts (cont)

/usr/src   /   bignfs:/export/sources   \
                                          linux   othernfs:/export/linux

/

usr/

src/
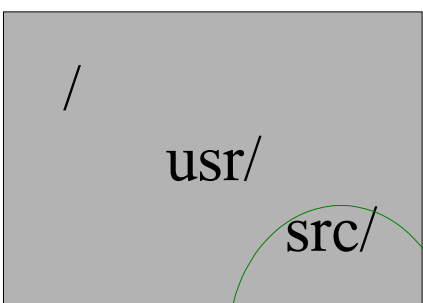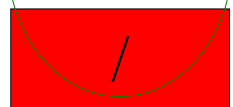
linux/

/

/

/
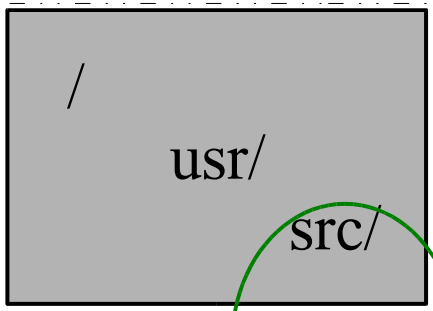
-t ext3 /dev/hda1

-t autofs
-o mapname=/etc/auto_direct
-o mapkey=/usr/src
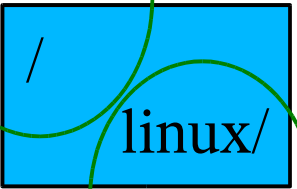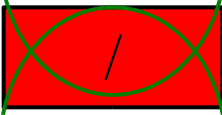
-t nfs bignfs:/export/sources

-t autofs
-o mapname=/etc/auto_direct
-o mapkey=/usr/src
-o mapoffset=linux/

Multimounts (cont)

/usr/src   /   bignfs:/export/sources   \
                         linux   othernfs:/export/linux

/

usr/

src/

-t ext3 /dev/hda1

/

-t autofs
-o mapname=/etc/auto_direct
-o mapkey=/usr/src

/
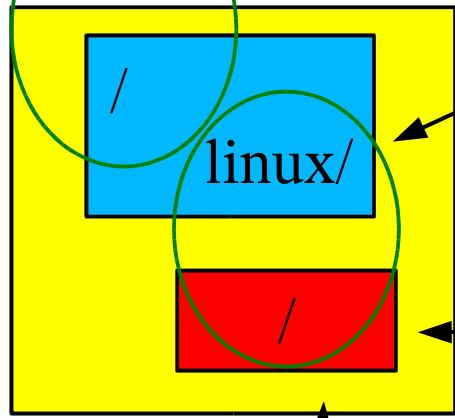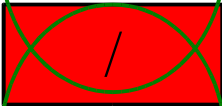
linux/

-t nfs bignfs:/export/linux

/

-t autofs
-o mapname=/etc/auto_direct
-o mapkey=/usr/src
-o mapoffset=linux/

Mounted Atomically / Expires Atomically

Multimounts (cont)

/usr/src   /   bignfs:/export/sources   \
                            linux   othernfs:/export/linux

/

usr/

src/

/
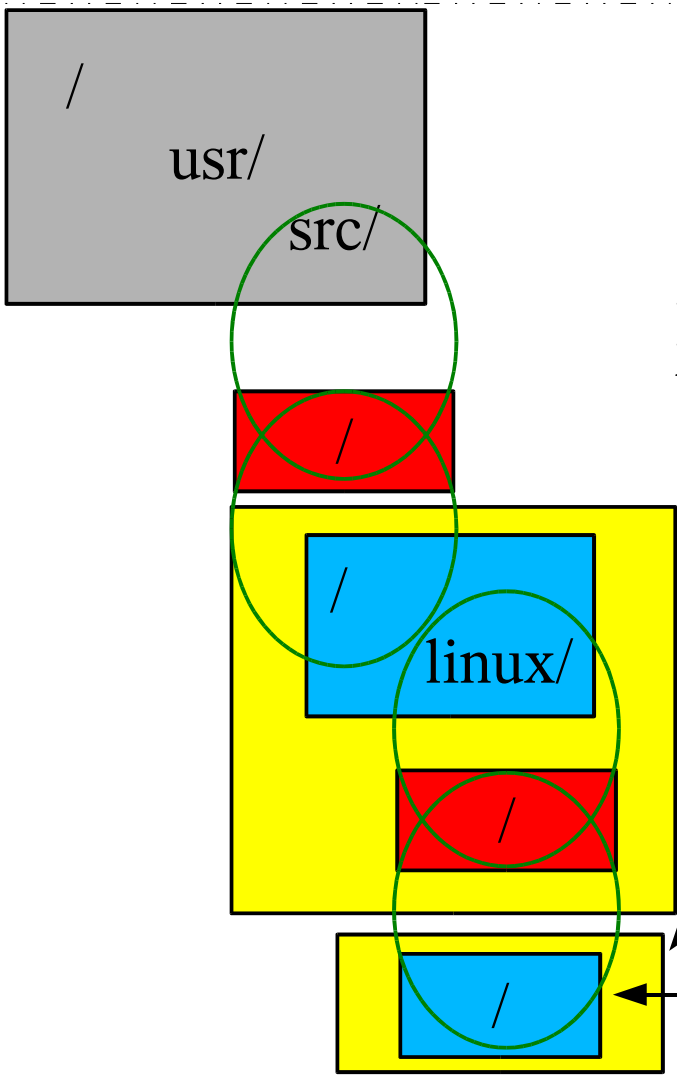
Each level expires atomically
but independent of each other

/

linux/

/

/

-t nfs othernfs:/export/linux

Project Status

- Alpha

- Need to work on Linuxisms

- Pass most of autofs connectathon testsuite

- Kernel + Userspace GPL
  http://autofsng.bkbits.net
  ftp://ftp-eng.cobalt.com/pub/users/ssmith